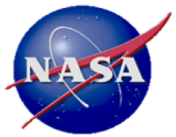
The LIS Land Model Open-loop (OL) Run

Step-2



In this presentation ...

- You will learn how to run LIS
- Perform a simple open-loop (OL) experiment involving Noah-3.6 LSM
- Look at the LIS model output

Running LIS: Our Testcase Overview

- Next, we will run LIS with the Noah land surface model (LSM), version 3.6, and the *open-loop (OL)* case.
- This test case uses the LDT-generated parameter input file, produced in the previous “Step 1” case, and will be used in the next few steps.
- The design of the testcase is to familiarize end-users with a full end-to-end demonstration of the LIS framework, and how each software component plays a role in this framework.
- The end-to-end test case includes:
  - *The Noah land surface model (LSM), version 3.6, and*
  - *SMAP soil moisture (SM) data assimilation (DA)*

Steps to running LIS …

1) Check out the LIS Framework (LISF) software from our new GitHub Repository
2) Set up and compile required libraries (e.g., netCDF, HDF5)
3) Configure and compile LIS to generate the ***LIS*** executable
4) Set up your *lis.config* file and select options and entries
5) Check that directory paths and filenames are correct prior to running
6) Run the ***LIS*** executable with your *lis.config* file:

   ./LIS -f lis.config

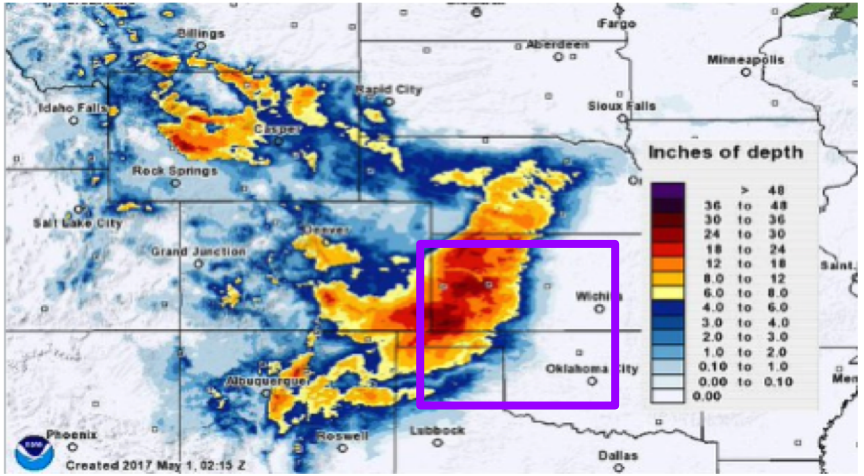
The Testcase Domain: Southern Great Plains (SGP)

- ***Focus region***: Southern Great Plains (SGP) area, spanning most of Oklahoma and Southern Kansas (based somewhat on https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=789610&tag=1)

#LIS domain

Map projection of the LIS domain:	latlon
Run domain lower left lat:	34.375
Run domain lower left lon:	-102.875
Run domain upper right lat:	39.625
Run domain upper right lon:	-96.125
Run domain resolution (dx):	0.25
Run domain resolution (dy):	0.25

- A late April of 2017, major snow storm event occurred across the Southern Great Plains and Rocky Mountains. Purple box in the map, on the right, highlights the test case study domain.



Interpolated Observed Snowfall Analysis, 72-hour preceding May 1, 2017.

Download necessary files to run this step …

1) Download the "*Step 2*" tarred-gzipped file from the LIS testcases webpage ("*testcase2_lis_ol.tgz*").

2) Unpack the above testcase files into your common working directory, `$WORKING_DIR`

3) Once unpacked, you will see the following directories and files:

- `INPUT` ➔ Contains Noah3.6 model input files and a script to download NLDAS2 meteorological forcing files;
- `lis.config_noah36_ol` ➔ The lis.config file for this testcase
- `target_OL_OUTPUT` ➔ The "target" open-loop (OL) output files generated by LIS
- `log/target_lislog.0000` ➔ The "target" LIS log file;
- `target_ol.xdf, test_ol.xdf` ➔ GrADS description files to look at the output.

Downloading the Meteorological Forcing Files

- The testcase is set up to use the *North American Land Data Assimilation System, version 2 (NLDAS-2)* meteorological forcing dataset:
  - Description found here: https://ldas.gsfc.nasa.gov/nldas/v2/forcing
- The NLDAS-2 dataset is available via the NASA GES DISC:
  - **https://disc.gsfc.nasa.gov/datasets/NLDAS_FORA0125_H_V002/summary**
  - A “wget” download script is provided and found in the **INPUT** directory from the files downloaded for this testcase ➔ ***wget_gesdisc_nldas2.sh***
  - Before running the script to download the data, you will need to “wget” installed and a NASA Earthdata Login account following instructions here (see steps “1. to 3.”):

https://disc.gsfc.nasa.gov/information/howto?title=How%20to%20Download%20Data%20Files%20from%20HTTPS%20Service%20with%20wget

Downloading the Meteorological Forcing Files

- Next, download the NLDAS-2 dataset:
  - Use the script provided in the **INPUT** directory ➔ ***wget_gesdisc_nldas2.sh***
  - cd to **INPUT**, and run at the command line: `sh wget_gesdisc_nldas2.sh`
  - The script will download 1 year's worth of NLDAS2 forcing data, for the entire year of 2017, and place it in the following subdirectory named: **`NLDAS2.FORCING`**
  - cd up one directory back to your `$WORKING_DIR`
- You should be now ready to run LIS and your lis.config file for this step.

The LIS configuration file: lis.config_noah36_ol

- The main LIS configuration file that contains the runtime options:
  - The LSM of interest (e.g., "**Noah.3.6**")
  - The name of NetCDF-formatted parameter file, which was created by LDT in previous step: e.g., **lis_input.nldas.noah36.d01.nc**
  - You can provide the name of the LIS diagnostic file: e.g., **lislog**
  - The date and time inputs, model options, parallel domain entries, etc.
  - Meteorological forcing dataset(s) selected; also some downscaling features.
  - Data assimilation entries, and other features, such as irrigation or runoff routing.
- The grid domain that was selected in the **lis.config** file will be placed in your NetCDF-formatted parameter file, and LIS will read that information automatically at the LIS run-time.

Running LIS – The “Open-loop” (OL) Step

- Copy your compiled ***LIS*** executable file into your `${WORKING_DIR}`
- Run the ***LIS*** executable with the Noah-3.6 model based lis.config file:

  `./LIS -f lis.config_noah36_ol`

- If running with a single processor, it should take *~20 minutes to run* …
  - NOTE: You could also run LIS in parallel mode, but for here, examples will be presented for 1 processor only.
- Was the run successful?
  - **Yes** ⇒ *Great job!*
  - **No** ⇒ *Let’s check for any run-time error messages or files …*
- Let’s check our ***`lislog_ol.0000`*** file to confirm how our run ended.

Viewing the LIS output files in: OL_OUTPUT

- You can look in the **`OL_OUTPUT/SURFACEMODEL`** directory, and you will subdirectories for: **`YYYYMM`**

  `YYYY ➔ 4-digit year`

  `MM ➔ 2-digit year`

- And in each of those subdirectories, you can find your netcdf output files containing the Noah-3.6 fields of interest (e.g., soil moisture, runoff, ET).
- You can use any visualization package to view the files, e.g., Matlab, GrADS, IDL.
- If you are using GraDS, you can use the descriptor files provided in this case.

Wrap-up of the LIS open-loop (OL) step

- You have now generated your LIS Noah 3.6 model run for the open-loop case.
- You can compare your newly generated files with the "*target*" versions, provided with this step of the testcase.
- The files you generated will be used then in the next two steps (*Step 3 and Step 4*) of our end-to-end test case …

  ⇒ **Step 3: *Generating an ensemble-based model restart file using LDT;***

  ⇒ **Step 4: *Generating LSM OL based CDF files using LDT.***